Claims

[c1] 1. A method for optimizing the design of a mechanical system comprising:

(a) determining a plurality of design parameters,

(b) determining a range of possible values for each of said design parameters,

(c) determining a space-filling Latin Hypercube Sampling design of experiment matrix based upon said ranges of possible values for each of said design parameters,

(d) creating a plurality of models of said mechanical system based upon said space-filling Latin Hypercube Sampling design of experiment matrix,

(e) creating a simulation test,

(f) simulating the performance of each of said plurality of models of said mechanical system with said simulation test, said simulating outputting a simulation result for each of said models,

(g) determining if any of said simulation results is a faulty simulation result,

(h) consolidating said simulation results into a simulation results summary, said consolidating comprising the step of discarding any said faulty simulation result, whereby said simulation results summary comprises a plurality of accurate simulation results, each of said plurality of accurate simulation results comprising a performance attribute result for each of a plurality of performance attributes,

(i) creating a plurality of response surface models, each of said plurality of response surface models being related to all of said performance attribute results in said simulation results summary for one of said plurality of performance attributes,

each of said plurality of response surface models being capable of modeling the performance of said one of said plurality of performance attributes over said range of possible values for each of said design parameters,

(j) choosing a desired performance metric for each of said plurality of response surface models, and

(k) optimizing the performance of at least one of said plurality of response surface models to achieve said desired performance metrics, whereby said optimizing outputs an optimal design parameter value from said range of possible values for each of said design parameters.

[c2] 2. The method of claim 1, further comprising the steps of determining a probability distribution for a range of variation for each of said design parameters and further optimizing the performance of at least one of said plurality of response surface models to achieve said desired performance metrics, whereby said further optimizing outputs an optimal design parameter value range from said range of possible values.

[c3] 3. The method of claim 1, wherein said optimizing the performance of at least one of said plurality of response surface models to achieve said desired performance metrics is accomplished by minimizing said at least one of said plurality of response surface models.

[c4] 4. The method of claim 1, wherein said optimizing the performance of at least one of said plurality of response surface models to achieve said desired performance metrics is accomplished by maximizing said at least one of said plurality of response surface models.

[c5] 5. The method of claim 1, further comprising:
creating an optimal model of said mechanical system, said optimal model based on said optimal design parameter value for each of said design parameters,
simulating the performance of said optimal model with said simulation test,
said simulating outputting an optimal simulation result, and
comparing said optimal simulation result to said desired performance metrics.

[c6] 6. A system for optimizing the design of a mechanical system comprising:
(a) a computer,
(b) an input unit operatively coupled with said computer,
said input unit being capable of receiving a plurality of design parameters and a range of possible values for each of said design parameters,
said input unit being further capable of transmitting said plurality of design parameters and said range of possible values for each of said design parameters to said computer,
(c) a first computer software program portion, said first computer software program being capable of determining a space-filling Latin Hypercube Sampling design of experiment matrix based upon said ranges of possible values for each

of said design parameters,

(d) a second computer software program portion, said second computer software program being capable of creating a plurality of models of said mechanical system based upon said space-filling Latin Hypercube Sampling design of experiment matrix,

(e) a third computer software program portion, said third computer software program being capable of simulating the performance of each of said plurality of models of said mechanical system, said simulating outputting a simulation result for each of said models,

(f) a fourth computer software program portion, said fourth computer software program portion being capable of determining if any of said simulation results is a faulty simulation result,

(g) a fifth computer software program portion, said fifth computer software program portion being capable of consolidating said simulation results into a simulation results summary, said consolidating comprises the step of discarding any said faulty simulation result, whereby said simulation results summary comprises a plurality of accurate simulation results, each of said plurality of accurate simulation results comprising a performance attribute result for each of a plurality of performance attributes,

(h) a sixth computer software program portion, said sixth computer software program portion being capable of creating a plurality of response surface models, each of said plurality of response surface models being related to all of said performance attribute results in said simulation results summary for one of said plurality of performance attributes,

each of said plurality of response surface models being capable of modeling the performance of said one of said plurality of performance attributes over said range of possible values for each of said design parameters,

(i) a seventh computer software program portion, said seventh computer software program portion being capable of optimizing the performance of at least one of said plurality of response surface models to achieve a set of desired performance metrics, whereby said optimizing outputs a design parameter value from said range of possible values for each of said design parameters.

[c7] 7. The system of claim 6, wherein said input unit is further capable of receiving a probability distribution for a range of variation for each of said design parameters, said input unit being further capable of transmitting said probability distribution for said range of variation for each of said design parameters to said computer, and further comprising an eighth computer software program portion, said eighth computer software program portion being capable of optimizing the performance of at least one of said plurality of response surface models to achieve a set of desired performance metrics, whereby said optimizing outputs a design parameter value range from said range of possible values for each of said design parameters.

[c8] 8. The system of claim 6, wherein said optimizing the performance of at least one of said plurality of response surface models to achieve a set of desired performance metrics is accomplished by minimizing said at least one of said plurality of response surface models.

[c9] 9. The system of claim 6, wherein said optimizing the performance of at least one of said plurality of response surface models to achieve a set of desired performance metrics is accomplished by maximizing said at least one of said plurality of response surface models.

[c10] 10. The system of claim 6, further comprising an eighth computer program portion, said eighth computer program portion being capable of creating an optimal model of said mechanical system, said optimal model based on said optimal design parameter value for each of said design parameters, simulating the performance of said optimal model with said simulation test, said simulating outputting an optimal simulation result, and comparing said optimal simulation result to said set of desired performance metrics.